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ABSTRACT

The influence of social trends, economic trends and developments in information technology on the information needs of the people of the United States is examined in this essay. The focus is on the period from 1975 to 1980, a time close enough to the present that some projections and predictions may be based on more than guesswork, yet far enough away that there is still time to plan and implement plans. After a brief introductory section, this essay deals in turn with economic trends, technology trends, and social trends, as each is likely to influence information needs. Some suggestions for meeting the needs indicated by these trends are interspersed throughout. The concluding section highlights the major questions concerning national information policy that are raised by the trends discussed. (Author/NH)

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INFORMATION AND SOCIETY

(A report to the National Commission on
Libraries and Information Science)

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PREFACE

The following essay examines how the information needs of the people of the United States are likely to be influenced by social trends, economic trends, and by developments in information technology. The focus is on the period from 1975 to 1980, a time close enough to the present that some projections and predictions may be based on more than guesswork, yet far enough away that there is still time to plan and to implement plans.

The work was supported by a contract with the National Commission on Libraries and Information Science. The "Needs of Users" committee of the Commission, consisting of Carlos Cuadra, Joseph Becker, and Alfred Zipf, provided helpful discussion during the initial preparation and in response to an earlier draft. Additional encouragement and stimulation was provided by another Commission member, Andrew Aines.

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After a brief introductory section, this essay deals in turn with economic trends, technology trends, and social trends, as each is likely to influence information needs. Some suggestions for meeting the needs indicated by these trends are interspersed throughout. The concluding section highlights the major questions concerning national information policy that are raised by the trends discussed.

I. INTRODUCTION

There are three basic factors making up our new, largely man-made environment, and hence determining the quality of life. The first is matter, the second is energy, and the third is information.

The three factors are related. The supply of matter and energy on this planet is finite; consumption of matter and energy cannot increase indefinitely without endangering the survival of the species. But information, which is the pattern of organization of matter and energy, has a potentially infinite supply. All our increases in material wealth flow from the discovery or the creation of new patterns in our matter and energy. Investment in the production of information (creation of new knowledge) and investment in widespread distribution of knowledge (e.g., through education) may be the only way to permit continued improvement in the quality of life without large increases in consumption of matter and energy.

All of the society's expenditure on science and technology and on research, development, and discovery in all fields can be viewed as investment in the production of knowledge. Policies concerning resource allocation for scientific and technical information must be considered in the context of that larger question of science policy generally. There are several related questions that need satisfactory answers. How much of society's resources should be allocated to research and development? How much of the research and development funds should be allocated to supporting scientific and technical information services? How can those funds be most efficiently utilized? Would more efficient scientific and technical information services

lead to a different optimum balance between such services and the balance of research and development activities? Could over-all efficiency of research and development activities be increased such that a different allocation between science and technology and the rest of society would be appropriate? Within the sub-area of scientific and technical information, how should funds be allocated between provision of present information services and research and development leading to more efficient future services? Who should make each of these resource allocation decisions?

Similarly, all of society's expenditures on education, broadly defined, can be viewed as investment in the distribution of knowledge. Policies concerning resource allocation for school and public libraries must be considered in the context of that larger question of education policy. Several questions need to be asked and answered. How large a share of society's resources should be allocated to education and other forms of distribution of knowledge? Can we afford to make education available to everyone throughout his lifetime on an equal opportunity basis? To what extent can education be made more productive (e.g., less costly without reducing quality), through the use of books and other media as a substitute for expensive human labor? How many of our education dollars should go directly into education services now, and how many should go into the development of media and institutions that can make future education less costly or more widely accessible? Who should make these allocation decisions?

Our society spends much money on the telephone network, communication satellites, computer information systems, broadcast transmitters, cable television, printing presses, xerox machines, library buildings, microfiche readers, record players, audio and video cassettes, and other information technology. How should we allocate resources between the technology for the storage and distribution of information and the preparation of messages to be stored and transmitted through that technology? Can investment in improved information technology significantly reduce the unit costs of storing and transmitting information? Could

an improved infrastructure of information technology permit the substitution of information for matter and energy; for example, by replacing some human travel with electronic teleconferencing? Would lowered information technology costs lead to productivity gains in business and industry? Does our economic system provide sufficient incentive for the development and installation of a technological information infrastructure that will lead to productivity gains in both the private sector and the public sector (e.g., in science and in education) of the economy? Are there major economies of scale to be gained such that public sector information services would be cheaper as part of a general purpose information system (e.g., via communication satellite and cable television) than if dedicated special purpose systems were developed? If yes, what policies are needed to insure that general purpose information systems have the capacity and characteristics needed by libraries and other public sector institutions?

Those who interpret narrowly the task of the National Commission on Libraries and Information Science may ask why libraries should be directly concerned with such questions. One answer is to argue for a broader perspective in which the Commission takes on the larger task of formulating and recommending an information policy for the society that goes well beyond the concerns and interests of libraries.

Another answer is that a major resurgence of libraries may result if the national leadership of this Commission is used to make libraries a major instrument for implementing a national information policy focusing on economic growth and improved quality of life through information services. As will be argued below, libraries and other public sector information services may provide a means of implementing a national information policy with perspective much broader than the traditional concerns of libraries. Technological changes should permit a lower unit cost of access to information. Social demands for more individualized information and education services are increasing. The economic and social benefits to be derived from investment in such services may together contribute to a major resurgence of libraries. This is because libraries have been the traditional source of on-demand public information and

education. Adjustments to new technology will cause stresses, but adjustment will permit libraries to continue their present functional role of providing on-demand information service to those who want it. Any other institution would have to adjust both in function and in technology to serve the needs. This paper assumes that libraries will not passively accept stable or reduced budgets and hence limit demand by restricting supply. Instead, it assumes that they will respond aggressively to the challenge and obtain expanding budgets by demonstrating the economic and social value of expanded information services.

Documentation of the present demand for information by individuals and organizations permits analyses of how present institutions might meet the projected demand. Such projections and analyses may be more prone to error in the case of information than similar analyses of supply and demand curves for conventional business. In conventional business supply can be thought of as the producers' response to consumer demand. Reduction of unit cost through productivity gains or economies of scale may lead to increased demand. However, in the case of information made available through public institutions such as schools and public libraries, demand may be determined by supply rather than by the needs of the people they serve. Public institutions with fixed annual budgets may find themselves unable to expand their supply of service if they found a strategy that stimulated demand. When increased demand does not automatically generate additional revenues, the supplying institution may be forced into service strategies that effectively limit demand in order to survive on tight budgets.

Consequently, conventional studies of information demand (sometimes called information needs) should be supplemented by an examination of the underlying economic and social factors that continue to influence the structure of both supply and demand for information. Of special interest are changes in information technology with potential for reducing the unit cost of access to information and hence increasing both supply and demand. Technology that permits delivery of information to individual homes (e.g., via television sets) is likely to lead to greater demand than technology that makes the information available only at public libraries. This is so,

even if the information is provided 'free' at both the television set and the library, because of the higher 'opportunity cost' of time and energy to get to the library.

A study of the information needs of a society would still be incomplete if it focused entirely on the information needs of individuals in the society. Information is a public good with external benefits, such that each of us may benefit when our fellows are better informed. Therefore, when viewed from the perspective of the society as a whole, the social need for information may be greater than the aggregate of the individual needs (or demands).

Even when these first-order external benefits are taken into account, the resulting conclusion about information needs may still understate the case. Although information may be valued by individuals and by the society as an important item of consumption, expenditures on information can be shown to be significant as investment leading to increased economic productivity. Economists with as differing views as John K. Galbraith and Milton Friedman (Galbraith, 1958; Friedman, 1962) agree that a free enterprise economic system leads to an underinvestment in education. In other words, the optimum investment in the distribution of information from the perspective of growth of the economy as a whole is greater than that which would result from individual investment. Thus, a careful analysis of the information needs of the society should also include an examination of the importance of investment in both generation and distribution of information as a means to productivity gains in the U.S. economy.

The broad sweep of social trends and values, described by some as a transition to a post-industrial state, may be merely an effect of underlying changes in the technology and the economic structure of society. Examination of those trends may yield additional insights that assist in the formulation of a statement of information needs for the last half of this decade. The goal of zero population growth, attempts to slow the rate of expansion of energy consumption, and conservation of non-renewable or recyclable materials do not appear to be passing fads. Pessimists may

argue that the views of the economic expansionists and the stability-seeking conservationists are irreconcilable. That debate is likely to continue for the rest of this century. But, social investment in information resources in this decade may be the key to eventual reconciliation.

II. ECONOMIC TRENDS

For present purposes, forecasting the general level of the economy in the period from 1975-80 does not seem like a very useful activity. One could extrapolate from the long run trend, with adjustments for a slowing rate of population growth and other factors. The result would be a prediction of a growing Gross National Product, but with a sizable margin of uncertainty associated with it. If we assumed a fixed distribution of components of GNP, then we would conclude that the demand for information services would increase proportionately with the growth of the economy.

More useful for present purposes is an analysis of the changes taking place in the composition of the national product. An examination of the changes in the significance of information relative to other components of the economy may lead to useful insights about information needs in the latter part of this decade, even if the data do not permit highly reliable numeric projections.

The most comprehensive analysis of the role of information in the U.S. economy was reported by economist Fritz Machlup in his 1962 book The Production and Distribution of Knowledge in the United States. Working with 1958 data, he concluded (page 362) that the production and distribution of knowledge accounted for 29 per cent of the gross national product in 1958. He included education, research and development, media of communication, information machines, and information services in that total, divided as follows:

Education	$ 60,194 million	(44.1%)
Research and Development	10,990 "	(8.1%)
Media of Communication	38,369 "	(28.1%)
Information Machines	8,922 "	(6.5%)
Information Services	17,961 "	(13.2%)
TOTAL	$136,436 "	(100.0%)

The breakdown of that total between Government, Business, and Consumers is as follows:

Government	$ 37,968 million	(27.8%)
Business	42,198 "	(30.9%)
Consumers	56,270 "	(41.3%)
TOTAL	$136,436 "	(100.0%)

According to Machlup's calculations, this total consists of 80 per cent Final Product (including both investment and consumption) and 20 per cent Intermediate Product (current costs of production of other products).

He does not attempt a formal breakdown between investment and consumption, but argues that the expenditures on information as investment exceed the consumption expenditures on information. (I will return to this difference between consumption and investment below, because it makes a crucial difference to what government policies with respect to information are adopted.)

Using two different estimation techniques, one based on incomes of workers in knowledge-producing occupations and one based on growth rates of knowledge industries, Machlup concludes that the information segment of the economy is growing at the rate of approximately 10 per cent per year, a rate approximately double that of the economy as a whole.

The following tables attempt to provide a crude indication of the growth of information related goods and services in the private sector of the U.S. economy between 1950 and 1970. Data are taken from the National

TABLE 1

COMPONENTS OF NATIONAL INCOME (current $)[1]

	1950		1960		1970	
	(Bil.)	(%NI)	(Bil.)	(%NI)	(Bil.)	(%NI)
NI (billions)	$239.17		$414.50		$798.63	
AGRICULTURE	17.38	7%	17.30	4%	25.55	3%
MINING	4.99	2%	5.51	1%	7.67	1%
CONSTRUCTION	12.40	5%	21.79	5%	42.79	5%
MANUFACTURING[2]	74.50	31%	121.02	29%	216.28	27%
WHOLESALE/RETAIL	42.78	18%	67.70	17%	121.19	15%
FINANCE[3]	20.53	9%	42.59	10%	89.96	11%
TRANSPORTATION	13.20	6%	17.91	4%	29.69	4%
COMMUNICATION/ UTILITIES[4]	7.16	3%	16.81	4%	31.41	4%
SERVICES[5]	22.31	10%	49.06	12%	102.66	13%
GOVERNMENT	23.37	10%	52.53	13%	126.80	16%
REST OF THE WORLD	.55	0%	2.29	1%	4.62	1%

1. Source: Survey of Current Business, U.S. Department of Commerce
2. See Table 2. Components of Manufacturing Income.
3. See Table 3. Components of Finance Income.
4. See Table 4. Components of Communication Income.
5. See Table 5. Components of Services Income.

Income Tables presented in the Survey of Current Business, U.S. Department of Commerce. Table 1 presents the general summary by major sector of the economy. Despite increases in dollar amounts, the percentage of national

income derived from manufacturing declined from 31 per cent in 1950 to 27 per cent in 1970. Agriculture declined from 7 per cent of national income in 1950 to 3 per cent in 1970.

Tables 2 through 5 present changes in those components of four sectors of the economy that can be interpreted as indicative of information products and services. Rather than attempt a finer breakdown, the sum of printing/publishing and electronics industries were taken as indicative of the information component of the manufacturing sector. Similarly, indicators of information components of finance, utilities, and services were examined in comparison with the category as a whole. Government expenditures, although a major factor in the total information product of the society, were omitted in this series of tables, because the purpose is to show what is happening in the rest of society so that government expenditure decisions can be made on a more informed basis.

TABLE 2

COMPONENTS OF MANUFACTURING INCOME

	1950		1960		1970	
	(Bil.)	(%NI)	(Bil.)	(%NI)	(Bil.)	(%NI)
TOTAL MANUFACTURING	74.50	31.1	121.02	29.3	216.28	27.2
PRINTING/PUBLISHING	3.61	1.5	6.55	1.6	11.90	1.5
ELECTRONICS	4.66	1.9	9.91	2.4	20.22	2.5
SUB TOTAL	8.27	3.4	16.46	4.0	32.12	4.0

If government expenditures were included, the information component of the National Income would be larger in total and show higher percentage increases. (This follows from the high percentage of government expenditure on information, as documented by Machlup, and the increase of government expenditures from 10 per cent of the national income in 1950 to 16 per cent in 1970.

TABLE 3

COMPONENTS OF FINANCE INCOME

	1950		1960		1970	
	(Bil.)	(%NI)	(Bil.)	(%NI)	(Bil.)	(%NI)
TOTAL FINANCE	20.53	8.6	42.59	10.3	89.96	11.3
SECURITIES BROKERS	.34	.1	.67	.2	2.84	.4
INSURANCE AGENTS	1.37	.6	2.36	.6	3.84	.5
SUB TOTAL	1.71	.7	3.03	.8	6.68	.9

TABLE 4

COMPONENTS OF COMMUNICATION/UTILITIES INCOME

	1950		1960		1970	
	(Bil.)	(%NI)	(Bil.)	(%NI)	(Bil.)	(%NI)
TOTAL COMM/UTIL	7.16	3.0	16.81	4.1	31.41	3.9
TELEPHONE/TELEGRAPH	2.96	1.2	6.99	1.7	15.08	1.9
BROADCASTING	.30	.1	.92	.2	1.69	.2
SUB TOTAL	3.26	1.3	7.91	1.9	16.77	2.1

Table 6 summarizes the information component of National Income for three years, showing an increase in the information-related components in the private sector of the U.S. economy from 10 per cent in 1950 to 14 per cent in 1970. The actual numbers (or percentages) are perhaps too crudely estimated to be meaningful. But they are consistently estimated and thus provide a solid indication of the trend. The factor of five increase in unadjusted current dollars (from $23 billion to $115 billion) and the factor 1.5 increase in percentage of total National Income indicates how

strongly information-related activities dominated the economic growth of the past two decades. These trends are likely to be accelerated in the decade of the 1970's, pushed along by the expansion of cable television, video cassettes, computer hardware and services, communication satellites and other advances in communication technology.

TABLE 5

COMPONENTS OF SERVICES

	1950		1960		1970	
	(Bil.)	(%NI)	(Bil.)	(%NI)	(Bil.)	(%NI)
TOTAL SERVICES	22.31	9.3	49.06	11.9	102.66	12.9
BUSINESS SERVICES	2.07	.9	6.04	1.5	13.89	1.7
MOTION PICTURES	.85	.4	.88	.2	1.55	.2
MEDICAL SERVICES	4.31	1.8	10.67	2.6	29.78	3.7
LEGAL SERVICES	1.62	.7	2.67	.6	6.43	.8
EDUCATION SERVICES[1]	1.09	.5	2.66	.6	7.29	.9
SUB TOTAL	9.94	4.3	22.92	5.5	58.94	7.3

[1] Does not include Federal, State or Local government services.

TABLE 6

TOTAL AND PERCENTAGE OF INFORMATION-RELATED COMPONENTS OF NATIONAL INCOME

1950		1960		1970	
(Bil.)	(%NI)	(Bil.)	(%NI)	(Bil.)	(%NI)
23.18	9.7	50.32	12.2	114.51	14.3

Another way of approaching economic trends is from labor statistics. Bureau of the Census data on the composition of the work force in 1950, 1960,

and 1970 can be compared with projections of the U.S. Department of Labor for 1980 (Bureau of Labor Statistics, Bulletin 1701, "Occupational Manpower and Training Needs," 1971.) Professional, technical and managerial occupations (and white collar occupations generally) are more concerned with processing of information than with direct handling of products. The trends and projections for this are shown in Table 7.

TABLE 7

PERCENT OF LABOR FORCE IN SPECIFIED OCCUPATIONS

	1950	1960	1970	1980 (projected)
Professional, Technical & Managerial	17.0%	21.8%	24.7%	27.8%
All White Collar Workers	37.5%	43.1%	48.3%	50.1%

The Bureau of Labor Statistics has also estimated the percentage increase to be expected in various occupations between 1968 and 1980. The increase in total number of white collar jobs is estimated at 50 per cent. The number of jobs in which an advanced degree is now considered necessary for professional advancement is estimated to increase by 38 per cent. In the job categories most concerned with new information technology, i.e., computer programmers, systems analysts, computer operating personnel, etc., a whopping 145 per cent increase between 1968 and 1980 is predicted. These are the occupations which make technical training rather than advanced degree training occupations the fastest growing in the work force.

These statistics provide a simple economic description of the dominant trend in the society: a shift from an industrial society to an information society. Such facts underlie the various qualitative discussions of what is described as the 'post-industrial society' or the 'knowledge society.'

Why is this trend taking place? The most likely explanation is that expenditures on information may constitute the most promising investment in improved economic productivity. Increasing productivity means producing more goods and services for the same amount of human labor. This usually means working smarter rather than working harder, i.e., applying new information to the production processes.

The trend in labor utilization in the past century has been to shorten hours and lessen manual exertion. The past gains have come from improved knowledge of production techniques (often a result of research and development activities) and from an increasingly healthy and well-educated labor force. Peter Drucker argues, "Knowledge, during the last few decades, has become the central capital, the cost center, and the crucial resource of the economy." (Drucker, 1969, page xi). J.J. Servan-Schreiber's American Challenge (1968) outlines what he sees as the United States' threat of economic domination of western Europe as essentially an information advantage. The recent Japanese 'white paper' titled "The Plan for Information Society -- a National Goal Toward Year 2000" (Japan Computer Usage Development Institute, 1972), recommends a major centrally planned development of what they call "the information society." They propose a 5-year investment of 1,000 billion yen (3.2 billion dollars). Their argument is that with such a national investment they can sustain an annual rate of growth of GNP in excess of 10 per cent per year, contrasted with a 7 per cent growth rate if the follow a U.S. style 'laissez-faire' policy of information investment.

A recent U.S. congressional report titled, "American Productivity: Key to Economic Strength and National Survival" also recommends investment in an expanded communication infrastructure as a key to U.S. economic growth. (Report of the Subcommittee on Priorities and Economy in Government of the Joint Economic Committee, Congress of the United States, July 3, 1972.) That report says, "Although a skeleton national computer net exists ..., expansion of such a net into a full-fledged computer utility, like other regulated utilities, could bring vast productivity gains at low costs in services where information exchange is basic." (Page 6.)

One form of investment in information is expenditure on education. Edward Denison (in his 1962 monograph, Sources of Economic Growth in the United States and the Alternatives Before Us, New York: Committee for Economic Development) attributes 23 per cent of the United States economic growth from 1929 to 1957 to increases in the level of education. He further attributes 20 per cent of the economic growth in the same period to advances in knowledge. When these figures are translated into economic growth per person employed, 42 per cent of the economic growth is attributed to improvements in education and 36 per cent to advances in knowledge. Another economist, Gary Becker, demonstrates that there is a greater return on investment in education for persons with lower levels of education than with higher. (Human Capital, New York: Columbia University Press, 1964.) Unfortunately, people with lower education are less likely to have savings over and above current consumption needs and are less likely to be able to borrow money to invest in their own education, or even to know the value of such education to themselves. Edward Phelps (Golden Rules of Economic Growth, New York: Norton, 1966) argues that optional investment in education becomes increasingly larger the more technologically progressive is the society. These arguments for social investment in education also apply to the public and other libraries that constitute a significant component of the total educational services available in society.

Will (and should) this trend to increasing expenditures on information continue? Given the goal of continued economic growth, then investment in information should continue to increase in total amount and in the percentage of the total economy. The argument for increases in the percentage of gross national product, not just increasing dollar amounts to maintain a stable percentage, follows from Phelps' argument for increased need for information as the society becomes technologically more complex.

But most of our economic productivity gains have been accomplished in the agricultural and manufacturing sectors of the economy. With manufacturing now providing only about a quarter of our national income and agriculture only about 3 per cent, we may be reaching a point of diminishing

returns. With total information expenditures by public and private sectors of the economy now exceeding expenditures on manufacturing and agriculture, the traditional growth arguments may not apply. Further increases in the information sector of the economy may not lead to as large an overall growth if the sectors in which the growth is expected to appear constitute an already small and further declining percentage of the total economic activity of the society.

Because of this diminishing returns problem in an increasingly information dominated society, two questions need to be analyzed more carefully than has been necessary in the past. First, more attention should be paid to the efficiency of expenditures on information. We are no longer an information-poor society in which most additional information services could be justified as leading to economic growth. We are becoming an information-rich society in which we need to consider more carefully which information services are most likely to lead to economic growth. The relative efficiency of different forms of expenditure in information services should be carefully analyzed. It would be silly to be inefficient in the expenditures in a larger sector of the economy (information) while claiming the goal is improved efficiency in a smaller sector of the economy (manufacturing). One of the key policy questions for the National Commission is what mix of private and public expenditures will be most efficient, and what level of government (local, state or federal) can best manage the government portions. The answer may be different for investment in information production than it is for information distribution.

The second major question raised by these economic trends concerns the need for investment focused on productivity gains in the information sector of the economy itself. If information is, as we have argued, an already large and fast growing component of the economy, then the best chance for productivity gains in the economy as a whole may be investment in research and development and in education that can lead to productivity gains within the information sector of the economy itself. Just as education and research and development led to dramatic economic gains in the agricultural and manufacturing sectors of the economy, (i.e., in the use of

matter and energy), so the appropriate road to further national economic growth may be through similar investment in research and education leading to more efficient and effective use of information itself.

Efficient Information Investment

What form of information expenditure is most effective? The first of our two major questions is most difficult, as the members of this Commission are certainly already aware. Better answers to this question would be one of the desired outcomes from increased expenditure on information about information, as suggested in our second major question. But some indications are available from previous research on this question. For a recent general collection of articles on this subject, see the recent Economics of Information and Knowledge , (Lamberton, 1971).

Perhaps the most important question for both economists and policy makers is the extent to which efficient allocation of resources is obtained through the private sector of the economy, i.e., through free market mechanisms. In a classic paper, Nobel prize-winning economist Kenneth Arrow (1962, pp. 609-626), argues that a free enterprise economy can be expected to underinvest in information production for three reasons. One is the 'indivisibility' nature of information, a second is inappropriability (the discoverer or inventor cannot obtain all the economic benefits from his discovery), and third is uncertainty. His arguments are made in the context of technical invention, but can be generalized to investment in information production generally.

With respect to distribution of information, even that most consistent advocate of free markets, conservative economist Milton Friedman (in his section on education in Capitalism and Freedom, [1962]), argues that the free market leads to underinvestment in education. He argues for both equity financing by the federal government (with payments returned through income tax) and subsidy in the form of fees good at any approved institution as ways of compensating for market imperfections that have led to that underinvestment.

The same reasons why education is primarily a governmental activity apply to libraries and other information institutions also. Nothing in the current economic trends is changing that need for continued governmental involvement in financing information services. Which level of government can most effectively supply those services is a question outside the scope of this paper.

Who needs the information services most? Becker's data (cited above) indicate that the least well educated (or least well informed) can most benefit (in the direct sense of increased dollar income) from increased education or information. There is a diminishing marginal return as higher levels of education are attained. Unfortunately for library policy and financing, the more educated and more informed are more likely to recognize the value of additional information.

Well educated middle class taxpayers may be the ones most likely to provide the political support for public library financing, even though economic efficiency arguments would argue that service policies aimed at those more economically and educationally deprived would be more socially beneficial than services desired by middleclass patrons. The better educated segments of the population may also be better able to afford information available through the private sector of the economy (e.g., by buying paperback and hard cover books). Information for the information-poor is more likely to be of benefit for both the individual and to the society as a whole. The information-poor are also economically poor and hence less able to obtain information from the private sector of the economy.

Some may argue against major investment in information resources for the economically and culturally deprived segments of American society. They maintain that such people do not want or would not utilize the information and would use such facilities only or primarily for entertainment. There are two fatal flaws in this argument.

One flaw is that it ignores the considerable elasticity of the demand

for information. When entertainment is cheap (provided 'free' by television because of advertising) and education and information have high social and economic costs, it is not surprising that people in economically deprived sectors of the society spend little of their limited energy and resources on investment in information to improve their future. They have enough trouble meeting the basic needs of the present. Conversely, if the society makes education and information resources as freely and easily available to all as television entertainment is now available, utilization of those resources could increase considerably. To compare present use of 'free' television and free libraries would be unfair on two counts. One is that much more money is spent (by advertisers) to subsidize television than is spent (by government) to subsidize libraries. Television has more incentive to work hard at attracting audiences. The second way the comparison is unfair is that libraries are far from free when the time and effort required for access by the user is included in the calculation. Becker's economic theory of the allocation of time provides a basis for a fairer comparison (Becker, 1965). This is not to argue that large numbers of people will suddenly switch from comic books to the New York Times or from the want ads to computer-aided instruction in the economic theory of international monetary transactions. The education and information will have to be perceived as relevant as well as inexpensive before it will be widely used. Understanding one's rights under the welfare or social security system, obtaining information of the 'Dear Abby' or 'Dr. Hippocrates' type, or learning basic job skills are examples of information likely to be in greater demand. The only way one can maintain the argument that information would not be used is to assume that information will continue to be as expensive to obtain as it is now or to assume that the information will be irrelevant to the needs and interests of those not now benefiting from existing information resources.

The second fatal flaw in the pessimistic argument is that it depends on a stereotype that denies the variability across individuals. It falsely assumes that all will react the same way. It may well be true that some will not make any use of improved information and education resources and that others will make only minimum use. But still others are likely to

make use of the opportunities presented. The economic argument for investment in human resources dictates that no people should be denied the additional opportunities that extended information systems can present. The implications of this economic argument coincide with those of the moral argument that claims we should not deprive some individuals of the benefits of improved information systems merely because others may not utilize them, or utilize them fully. Suppose a similar debate were held soon after Gutenberg's development of the printing press. A strong case could be made against widespread diffusion on the grounds that the illiterate public would not use it anyway. The force of the argument would have been stronger then than now, but is equally flawed, as history has shown.

Providing public library service for the least well educated and well informed segments of the population may imply a shift in the kinds of media and services provided by libraries. More emphasis on audio and video media with a consequent relative decline of emphasis on print may be called for. Shifts in geographic location and in library staffing may be required to make services more accessible both physically and socially. Different kinds of reference service and educational programs may be required to meet the needs of less well educated segments of the population.

Providing services that lead to a better informed population distribution of knowledge is one avenue to productivity gains in a national economy. A second is to provide information services that facilitate the production of knowledge. Information services in support of research and development activities, such as major research libraries and science information programs and education services, should both receive support as part of a strategy of information investment for economic growth.

Information Research and Development

The second major question raised by the trends in the economy concern the importance of investment in activities intended to make the information sector of the economy itself more productive. Productivity gains and economies of scale in manufacturing have led to lowered unit costs of most

manufactured goods. Information services, such as education and library services, generally have not benefited from similar cost reducing changes in their means of production and distribution. George Pake (1971, p. 908) discussed the crisis in higher education in the United States and pointed to the productivity problem as a key issue. He cited costs per unit of instruction that increased by a factor of four during the decade of the 1960's in many universities. He said a major challenge to educational institutions is to find a way to use technology to increase the productivity of teachers. The same comments can be applied equally well to education at all levels, including public education services of libraries.

This is not just a problem for libraries and other educational institutions. It is a national economic problem of considerable magnitude. The rate of economic growth of the United States is lower than that of Japan and other countries. This points to a relative decline of the United States as a world power unless ways are found to improve the rate of economic growth. Investment in an improved information infrastructure may be essential for a smooth transition from a manufacturing society to a knowledge society. Development of information utilities that permit economical on-demand access to information services from most homes and offices may be the most promising road to national economic growth. As will be discussed in the following section on technology, the advent of two-way cable television, communication satellites and computer information systems can permit the construction of a national information system that could spark rapid economic growth. Although investment costs would be high, both in the research and development needed and in the capital costs of installing such a system, the gains are likely to be immense. The extension of information services now provided at libraries (on-demand information and education) to most homes and offices at costs the society can afford may be the most significant factor influencing the U.S. economy in the last quarter of the present century.

Major development of a technology-based information infrastructure permitting significantly lowered unit costs of access to information and

education may spark a period of economic expansion analogous to the railroad building era a century ago. As indicated above, the Japanese appear to be betting that they can build such an information infrastructure for their society and maintain a sustained rate of economic growth in excess of 10 per cent per year as a result.

In the United States, as in Japan, much of the investment would come from the private sector of the economy. But, as was the case in the development of transcontinental railroads, government participation in policy formation and in the provision of leverage funds to influence the direction of development would be necessary.

III. TECHNOLOGY TRENDS

There are several major trends in the development of information technology that are likely to have a significant impact on the demand for library and information services in the period 1975 to 1980. The key technologies in which major changes can be expected are cable television, communication satellites, computers, and a cluster of video technologies (tapes, cassettes, cartridges, disks).

Technology projection is a risky business. We typically tend to overestimate the amount of change taking place when we project only one or two years ahead. In 1971 and early 1972 the predictors were saying that video cassettes would achieve major penetration of the home consumer market during 1973. Since then, sales to institutional markets have grown, but sufficiently reliable and economical products to reach the home market in a major way are still a year or two away. Now the technology predictors are saying that video disks rather than video cassettes may be the vehicle for major penetration of home markets and that 1974 or 1975 are more reasonable dates. Similarly, in computer information systems and computer aided instruction systems, the technologists who promised major national changes within a mere two or three years have been shown to be too optimistic. More pessimistic views (such as those expressed by Anthony Oettinger in his book, Run, Computer, Run [1959]) have proven more realistic in their assessment of the economic and institutional barriers to technological change.

Despite this tendency for technology prognosticators to overestimate the extent of change in the following two or three years, there also appears

to be a tendency to underestimate the amount of change in a period of five to ten years. In 1950 many computer experts were convinced that perhaps as few as half a dozen large computers would serve all the computing needs of the nation. By 1960 most large businesses were computer users. By 1970 almost every individual in society has had contact with computers in some form, either through school scheduling, employment, consumer credit transactions or involvement with government. By 1980 computers may begin penetrating the home consumer market as well as provide services for government and business (possibly through time-sharing services for household information and entertainment accessible from cheap terminals attached to a telephone or a television set). In the late 1950's the first satellites were launched. By the late 1960's satellite communication was a major international business. The launching of Canada's domestic communication satellite in late 1972 and the 1972 FCC authorization of several domestic communication satellite systems for the United States signals a new trend in communication technology with major social impact to be felt before the late 1970's.

To some extent prophecies can be self-fulfilling, expecially when made by influential federal policy makers in the United States. Policy makers sometimes have it in their power to influence the trend being predicted by developing policy consistent with those predictions whether they be optimistic or pessimistic. Therefore, it may be advantageous to develop a scenario of what could happen, in case the policy makers choose to try to make it come true. Such a scenario is not the same thing as a prediction. Rather it is a possible future intended to suggest options and possibilities. The following section provides such a fantasy of what the state of communication technology might be if we look back on the 1970's with hindsight from 1985, making many optimistic assumptions in the process.

1985: A Communication Fantasy

Nearly every home, school and office in the country is, now, in 1985, obtaining the benefits from an information technology initiative begun in the 1970's. Some of the most dramatic changes that have taken place in society in the past 15 years can be attributed to the nationwide implementation of information and education services making use of the telecommunications technology: cable television, communication satellites, computers and video cassettes.

In these 15 years, the television set has been the focal point of the changes taking place. In 1970 the television set was like the passenger train. It took people to scheduled places at scheduled times. You could look up the schedule to find out what you could see at what time. It provided a window on many different lands, some real and some fantasy. But some lands you could not see at all, because the 'train' did not run there. Others were only available at infrequent and awkward times. Now, in 1985, the television set is like the personal automobile. Instead of a small number of routes with scheduled times for traveling them, there are a myriad of roads to take and you can 'travel' any one of them at any time to learn whatever you want to learn whenever you want to learn it.

Even in 1970, television was being used for education, some of it very good. Sesame Street, for example. But there was seldom more than one channel. And for any given person at any given time, it was not really showing what he wanted to see. Which was not surprising given the fantastic variety of different people of different ages, different interests, different backgrounds and different skills. And with all the different things in the world to learn about, it is no wonder one scheduled channel was not enough. And learning by passively watching the television screen was not as much fun (or as effective) as active participation where you were really doing something interesting.

Now, for our children, the television set has become the window into the information utility that permits them to work on any section of any

course when it is convenient, just like taking out a particular book from a large library and turning to the third chapter. Except that now they do not have to walk to the library, the book is never checked out to someone else, and they can type in some questions on the television response panel and have the answer displayed on the television screen. Often the 'book' asks them questions and then tells them immediately if their answers are correct. It hardly seems like the same television set, now that the keyboard and the video cassette player are added to it and there are computers and satellites somewhere at the other end of the cable. The children still have schools and teachers because there are many things the new communication technology cannot do, especially in responding to emotional needs. But the teaching of subject matter competence in most areas and the retrieval of information is better done through this new technology.

The transition of the television set from a 'passenger train' to an 'automobile' began back in the 1970's when cable television began its expansion in the large cities. At that time, the FCC lifted its ban on bringing additional television signals into the 100 largest cities and required at least 20 channels of television capacity on the cable. Many of our cable television systems today still have that 20 channel capacity, although the more modern ones have expanded to 40 or more channels.

Other systems have been rebuilt so that all the channels do not go directly into every home. Instead, the 'trunk' lines go to neighborhood switching centers. In some cases the 'trunk line' capacity has been expanded to permit up to 200 channels. Since the television set can only be tuned to one channel at a time, a single channel to the switching center from each television set is enough to permit access to all the channels.

In these newer systems, some of the neighborhood centers have video cassette 'juke boxes' with a large library of cassettes including a lot of educational materials. It sure is nice to be able to study anything from Beginning Chemistry to Advanced Golf whenever you want, in full living color with the stop action, slow motion and instant replay under your own

control. If you want to watch something that is not in the neighborhood cassette library, all you have to do is type in a request on the keyboard that now comes with the television set. They transmit it overnight from the nearest big city library that has a copy and record it at the neighborhood center for showing any time the next day. They say communication satellites are used for the transmission from the big libraries whenever the distance is more than about 35 miles. In the 1970's, NASA experimented with communication satellite systems dedicated for educational uses. That was very exciting and served to convince everybody of the need, once people saw it could be done and how useful it was. But now they have found that it is cheaper to send educational materials at discount rates on the regular satellites used to interconnect cable systems for entertainment and commercial services.

Many of the cable systems still have just the 20 channel capacity built in the 1970's and many neighborhoods do not yet have the local cassette libraries. Experts are now predicting that we will all have that capability by 1990.

The first regular uses of the two-way cable communication capability came in late 1973. It took nearly two years of research after the hardware was first available to complete the curriculum and program development needed to effectively use the two-way capability for teaching.

Satellites were used in a nine-month demonstration project in 1974 to distribute instructional television directly to schools and to cable television systems throughout the Rocky Mountain region of the United States. But that did not change the kind of instruction much. It distributed one-way instructional television signals to many different places that would not have received it otherwise. It was a big step in the right direction but did not get the recognition it deserved because the quality of the average program was not as high as that possible for a single national program like Sesame Street. The 1975 experiment with wider geographic distribution and experimental two-way capability is now recognized as the turning point in use of satellites for education.

By late 1974, video cassette players were beginning their rapid expansion in the consumer market. Since the players were attached to the television set, we began to get used to using television like a record player with moving pictures. But most people could not afford large collections. There were rental libraries available, but that was not as convenient as having immediate access from your own home. When we wanted to learn something the cassette was better than a book or a correspondence course for explaining how things worked and showing how to do things. You did not even have to be able to read very well to follow the pictures and spoken words. One of the problems though was that the people who could not read very well could not afford the cassettes and players. So those of us who were already 'information rich' got richer and the 'information poor' got poorer. That was part of the reason why the government put all the research and development money into systems that could provide everyone with access to information.

By 1975 a few 'pilot project' communities had a system installed that permitted television sets to be used as a computer terminal. There were several different technical ways of accomplishing that goal. One of the simplest was what they called a 'frame-grabber'. It was like a rugged, simplified video recorder that recorded only one still picture. The appearance of continuous motion in television pictures comes from the fact that a new 'still' picture is transmitted down the cable (or over-the-air) 30 times every second, with each new picture replacing the one that went before. Given the speed of electronics, there was plenty of time to send short messages in the time between each new picture every thirtieth of a second. That was used to transmit the 'address' of particular television sets that were to receive the next picture or 'frame', as they called it. The 'frame-grabber' recognized its own address and copied the next picture on the local storage device. Then the television picture was 'refreshed' locally instead of from the cable. The touch-tone pad connected with the television set (or, in the more expensive models, typewriter keyboard) was used by the viewer to control what he wanted displayed next. Since each frame had to be displayed a lot longer than one-thirtieth of a second for people to look at or read the

display, a single television channel could be used by at least 300 people (and sometimes twice that many) at the same time. Of course, they got only still pictures, when using the television set this way. That 'frame-grabber' system permitted a wide range of computer-aided instruction and information retrieval services.

State legislators began to see the economic benefits to be gained from adding adult and continuing education services by telecommunications instead of continuing to build new community colleges every year. Since the need for 'lifelong learning' was constantly increasing and new community colleges were not able to serve all the people anyway, the new expansion came in telecommunications for continuing education. But that did not happen until after the half-dozen federally supported community demonstration projects showed what could be done.

So the telecommunications system for education developed not primarily for children in the 12 grades of public school, but for preschool, supplementary, and continuing education made available directly to homes, offices, neighborhood day care centers and adult learning centers. Since libraries were the major institutions already offering on-demand information and education services to adults, most of the adult learning centers began as libraries expanding their service offerings.

Now, in 1985, communication satellites are used to interconnect the cable television systems that provide all these services and to provide direct broadcast to low cost receivers in remote locations. For educational television alone (both one-way and two-way services) there are five television channels of national service in each time zone. Two channels are direct broadcast on the national networks. The other three channels of educational satellite capacity are used to send special programs on demand to local cable systems, when they have a demand that they cannot fill from their local resources. That way most systems can provide service within 24 hours for any instructional program that is available anywhere in the country, even if they do not have a copy locally. Those three channels are used for filling real-time requests for digital or still picture

information, with non-peak channel capacity used to transmit requested motion video in slack time (usually overnight).

The five channels of television bandwidth in each time zone are needed for transmission to the satellite from any of the dozen or so regional centers around the country and thus for transmission to any of the local systems, either within their regions or to other regions.

Approximately one-tenth of that bandwidth is required in the 'reverse' direction. That is primarily for request from local cable systems to the regional centers or from one regional center to a national center or another regional center. This 'return' communication capability from every local cable system and from individual 'home' receivers in remote areas is also used for the student responses in two-way television and for handling requests for information retrieval and other computer services. Some of the regional centers (especially in Alaska and Pacific Trust Territories) provide services to home receivers directly by satellite.

The size of local and regional libraries or information banks depends on the number of local and regional requests for information. When there is a request for information, (text or still pictures, but not motion video) that cannot be filled locally, the request is transmitted to another regional center in real-time for immediate response. The regional centers are interconnected (via satellite) in a decentralized network with each one able to 'dial into' each of the other regional centers just as if they were one of its local systems.

The kind and amount of information kept in each local and regional library was carefully planned on the basis of comparing local storage costs with communication costs involved in retrieving it from elsewhere. National coordination was involved in reaching the administrative agreements guaranteeing that there was a copy of everything of interest in at least two places.

Much of the research needed for the development of this system was in

the computer software needed to make it possible on a reliable basis. Most of the costs were for development of programs to effectively use the technology. Most of the problems were organizational and administrative. Fortunately, the Federal Government began in 1973 to finance the far-sighted program of research, development and demonstration programs that led to the present benefits.

1980 Information Technology: A View from 1973

A more conventional way to look at trends in technology is to project from the present. Two recent papers by the present author have attempted part of this task. One is a chapter, "Technological Change and the Mass Media," in the forthcoming Handbook of Communication (Parker, 1972). The other is titled "Information Technology: Its Social Potential" (Parker & Dunn, 1972). A recent projection of trends in video technologies with emphasis on implications for libraries is provided in an Annual Review of Information Science chapter by Richard Kletter and Heather Hudson (1972). Since these articles were written, the Federal Communication Commission has completed (in late December 1972) its rule-making in the Domestic Satellite inquiry and, after many years of debate, implemented an 'open skies' policy which is likely to result in as many as seven competing domestic communication satellite systems in the next few years. The first (by Western Union) is scheduled for launch in early spring of 1974. Other contenders, including RCA, may begin operational service even earlier through channels leased from the Canadian Telesat Corporation (whose Anik satellite went into operational service on January 11, 1973). By signing two year leases for channel capacity on Anik, with service beginning in July 1973, these companies can begin service on rented channels this year, switching to their own satellites after they are launched in 1974 or 1975.

Four main differences in communication technology will distinguish the 1975-1980 period from the present. First, domestic communication satellites will lower many long distance communication costs (other than voice telephone) and make distant locations accessible. This will permit the expansion of computer information networks on a national basis with costs independent of distance and significantly lower than present long distance data communication costs. It will also boost the growth of cable television by providing economical national interconnection, thus greatly expanding the program availability in each location. It will permit remote communities (for example in Alaska and in the Trust Territories) that are now without reliable communication by telephone, radio, television

or otherwise to be connected to the rest of the society. This process is starting in the Canadian arctic in January 1973 on a small scale and is being demonstrated via an experimental satellite in Alaska. In Alaska, library story hour programs originated in Fairbanks, Juneau, or Anchorage are being heard in remote Indian and Eskimo communities previously lacking radio or telephone service (e.g., Anaktuvuk Pass). The same satellite (NASA's ATS-1) is being used regularly to connect a computer terminal in the hospital library of the Alaskan Native Health Center in Anchorage with the Medline service of the National Library of Medicine (via a Stanford University ground station and a terrestrial computer communication network linking the west coast with Bethesda). These are small forerunners of the future. Most of the effects of satellites will be in reducing the economic effects of distance on communication, permitting rapid expansion of computer and cable TV networks on a national scale.

The second main difference will be the diffusion of video recording. We are now in a period of competing technologies (video cartridges, cassettes and disks) and competing standards. The standards problem is in many ways analogous to the technical standards problems that delayed the diffusion of long playing audio records in the 1940's. Whichever technologies or standards emerge in the next two years are likely to be rapidly diffused through society in the last half of the decade. One effect is likely to be a boost for cable television, with video disks serving for cable much the same function that records have served for radio, that is a cheaper form of programming than could be produced through live local programming. The availability of video disks in homes may shift a significant amount of present television viewing to 'on-demand' selection. Even if most viewers spend most of their viewing time watching programs selected by broadcasters or cablecasters, it will become generally accepted that motion-video can also be a medium accessible, like books and audio records, at times and places of the viewer's choosing. That general attitude will make a significant difference to demand for instructional and entertainment content. Whether that demand will be made of public libraries will depend in part on whether libraries encourage it

by offering service. It could be argued that demand on libraries for audio services has been relatively low, perhaps because the relative scarcity of audio service offerings may have inhibited such demand. The continuing 'book image' of libraries has perhaps prevented many potential patrons of libraries from viewing libraries as a community resource for information, education and entertainment in all media. A nationwide program of expanding library service offerings via audio and video disks or cassettes in the 1975-80 period could make libraries a major source of information for all of the public, not just the book reading minority. To meet the needs of the disadvantaged, viewing carrels as well as cassette lending programs will be required. The social demand will be there, created by the general awareness of video recording that will permeate the society in 1975-80 as a result of the technological change. Whether libraries are able to obtain and allocate the resources to meet that demand is another matter.

The third major difference is the continued expansion and diffusion of computer services throughout the society. To the present, computers have been serving the major institutions of the society, government, schools, businesses, etc. There are few people whose lives have not been touched in some form by computers, whether it is computerized school scheduling techniques, revised work procedures or computerized billing for goods purchased. Computers constitute one of the fastest growing components of the economy, as indicated by the Bureau of Labor Statistics projections cited earlier. More and more people will become more closely involved with computers during this decade.

Computer services industries are expected to grow much faster than other components of the computer industry. A recent report, "Computer Services Industry" (Creative Strategies, Incorporated, 1972) projects the growth as follows. They predict revenues in four segments of the computer services industry, business package software, data centers or service bureaus, time-sharing and facilities management. Revenues are

expected to increase from $2.1 billion in 1971 to over $7.5 billion by 1976, an impressive compound annual growth rate of nearly 29 per cent. The following table details the projection for each segment of the industry:

Industry Segment	1971 Revenue ($ millions)	1976 Projected Revenue ($ millions)	Annual Growth Rate
Business Package Software	$ 102	$ 325	24%
Data Centers	1,500	4,000	21%
Time Sharing	330	2,000	43%
Facilities Management	175	1,500	53%

The report comments: "A major trend of importance, the growing orientation toward communications, is seen for the industry, as evidenced by recent developments in nationwide computer networks and the increasing incorporation of data communications capability in mainframe computers. It is expected that by 1976 one-half of all installed computer capacity will include this capability. Access to more remote markets at lower costs will result from networks' growth and very significantly affect the entire industry."

The main direct impact on libraries during the 1975-80 period will be for internal library data processing (e.g., acquisition, cataloging and circulation systems) and for library networks (just as medical libraries now have on-line time-shared computer access to the National Library of Medicine via a commercial computer time-sharing network). Both cost-saving and expanded service offering will provide the motivation for such expansion of the computer industry into libraries, but the net result may be to increase total costs by increasing service demands. The unit costs of library operations may come down, but the expanded service opportunities and demand created are likely to create pressures requiring total budget increases rather than decreases. The National Library of Medicine, the MARC magnetic tape service of the Library of Congress, the on-line library

functions provided by the Ohio College Library Center to many libraries, the New York Times on-line library, and the automated Stanford University Library all provide examples of the trend to be expected in 1975-80. Another indicator of things to come is the growth of commercial on-line information retrieval services, such as Lockheed's DIALOG, System Development Corporation's ORBIT, and services by Informatics, Mead-Data Central, IBM, and others. The growth of such commercial services and increasing public awareness of them will make possible a range of services and generate an expanded demand for services that could be provided by or through libraries.

The increased use of on-line computer services in libraries as well as for management information systems in business will start another trend in a small way in 1975-80 that could grow to major proportions in the 1980's. During the 1975-80 period there is likely to be much experimentation with on-line information services for the general public. One example might be on-line library reference services permitting library users to find out what community services are available in their community and how to obtain them. The problems of managing one-stop information referral centers may be resolved through on-line techniques permitting centralized preparation and modification of records that need to be searched at geographically dispersed locations. On-line union catalogs of library holdings searchable by library users could be another example.

We can expect that computer services will diffuse through many more and smaller types of businesses and institutions during 1975-80, that a steadily increasing percentage of computer use will be for information retrieval services, and that communication and networking will dominate the trends. By the end of the decade a consumer market in computer information services is likely to be starting on a small scale, poised for rapid expansion in the 1980's. A recent Institute for the Future report by Paul Baran (1971) provides an indication of what can be expected. This report, based on an extensive 'Delphi' study, projects a market of greater than $20 billion per year in the 1980's for two-way information services to the home. Education is expected to account for

35 per cent of the total market.

There are already faint beginning indications of this trend toward individual (rather than merely institutional) use of computers. Volume 1, number 1 of The People's Computer Company (1972), says, "Computers are mostly used against people instead of for people, used to control people instead of to free them. Time to change all that. We need a people's computer company." They advertise the People's Computer Center (1921 Menalto Avenue, Menlo Park) where anyone, young or old, can come in to use computer facilities, sometimes for as little as 50 cents per hour. Another indication is an article in a recent issue of Rolling Stone, a popular culture paper where one is more likely to expect information about rock musicians than computers. But a long feature article on December 7, 1972 (page 50) describes the growing use of computers for entertainment, citing the game Spacewar as its major example. The article starts, "Ready or not, computers are coming to the people." The availability of coin-operated computer games such as Spacewar and Pong at coffee houses and elsewhere in or around university campuses is another portent of this future. The expansion of computers in business and government may have been just the infancy of the computer industry. That continued growth in the 1970's may set the stage for major growth of computer services for individuals and small groups, via telephone or cable television networks, in the 1980's.

The fourth major difference between the present and the latter half of the decade will be the diffusion of cable television throughout the major urban centers of the United States. Concomitant with this will be the growth of a major market in pay television. According to the 1972-73 issue of Cable Sourcebook, there were 6 million cable TV subscribers in 1972. Their data came from compilations of FCC records. The new FCC rules that went into effect on March 31, 1972, and the minor modifications made in the summer of 1972 concurrently with the denial of most petitions for reconsideration, now provide a stable regulatory base for cable television. The report of the President's Cabinet-level Cable Television Task Force, not yet released, is widely rumoured to contain a recommendation for

legislation making cable television a common carrier, but only after a long transitional period permitting cable television to grow under current regulations.

The immediate result of the rulemaking was a wave of corporate acquisition and mergers that have converted what was formerly characterized as a 'Mom and Pop' industry into a consolidated industry in which the top three corporations serve 25 per cent to 30 per cent of all American subscribers and the top ten corporations serve nearly 50 per cent (Cable Sourcebook, 1972-73, page 3). This revised corporate structure of the industry is permitting the capital acquisition from insurance companies and other financial sources, needed for a major expansion program in the next five years.

Spurred by the distant signal importation permitted by the new rules and the opening up of pay TV markets, cable is likely to grow in the late 1970's and early 1980's at a rate approaching that of the diffusion of television itself in the 1950's. The vision of a whole range of potentially profitable two-way cable services in the 1980's contributes to the glamour of cable TV and the long-range optimism of the industry even though other services are not expected to provide much in the way of tangible revenue in the next five years. The FCC requirement of two-way capability on all new construction in the top 100 markets and the economic attraction of home digital response terminals for pay TV program ordering will provide the carrot and stick to install at least the limited two-way capability that will permit experimentation with other two-way services (including information retrieval and other library-like services) in the latter part of the decade. Early technical demonstrations of such services have been conducted by the Mitre Corporation on the Reston, Virginia cable system. Their December, 1972, report, "Interactive Television" (Mitre Corporation, 1972) summarizes past experiments and discusses future plans for a series of demonstration projects.

As indicated above, developments in computer services, in video technology, and in communication satellites are likely to have impacts that

will further spur the growth of cable television in the 1975-80 period. The net effect will be what the Sloan Commission on Cable Television referred to as the television of abundance (Sloan Commission, 1971). There will be more channels of video information and entertainment to choose from; there will be pay television by the channel and by the program in addition to advertiser supported television; there will be more on-demand access to video through video disks or cassettes and through video 'request' programs on cable analogous to radio shows playing records requested by listeners.

What will be the effect of these four technologies on the need or demand for public information services? Conventional market research techniques are not very satisfactory for estimating demand in technologically changed circumstances. Some interview respondents will willingly 'play science fiction' with the interviewer and project many potential uses and demands in the projected technological environment. Unfortunately, they may not be good predictors of their own future behavior when the environment really does change. Other interview respondents, less able to visualize or accept the predicted change in technological environment, may respond as if their environment won't change, that is they predict a continuation of their present behavior without change. They too are not necessarily good predictors of their own future behavior when the changed environment forces some kind of adaptation to changed circumstances.

The strongest indication of changing demand for information services is the past and predicted expansion of the services made possible by the four technologies we have been discussing. We seem to be in the midst of a chain reaction process (possibly the same one started by Gutenberg) in which information technology lowers the unit cost and increases the availability of information, generating more demand for information that sparks new advances in technology. This chain reaction process of new technology generating new demand is likely to continue for the foreseeable future. Although difficult to quantify, all indications are that information demand is the fastest growing in the economy with no levelling of demand in sight.

The previous 'information explosion' and 'information input overload' problems resulting from having more information already available than we know how to process, have not resulted in any decrease in demand. Instead, it has generated a need for more individualized information channels and information filtering techniques so that each individual can select what he wants or needs from the mass of information available in the society.

The electronic mass media have extended media access to the entire society in a way that print never did, despite near-universal literacy. But that mass availability of video on a limited number of channels (in some communities not even all three of the major television networks) may be just the start of the video information explosion. The growing proliferations of media content, both print and video, becoming available for on-demand access is also creating a great demand for techniques for learning about the availability of media content and obtaining access to it. Fortunately, computer information systems are being developed to solve this access problem, but inevitably generating further demand as a result.

Of special concern to the National Commission on Libraries and Information Science should be demand created for public information services, such as those provided by public libraries and government agencies rather than by profit making companies. If the private sector of the economy was effectively meeting the information demand at progressively lower unit costs and if incomes of all segments of the population were rising such that all could afford the information services they wanted or needed, then there would be little need to increase or even maintain the existing level of public information services. Unfortunately, the trend, at least in the short run, will be for the information rich to get richer, and the poor to get left behind. Those with higher incomes (who are usually those with better education and better information processing skills) will have both the money and the skill to effectively utilize on-demand information services available through the private sector of the economy. They are also more likely to recognize the value of information. The people who most need information and education are less likely to recognize the advantages information can bring them, are less likely to have

the skills to most effectively utilize information resources that are in principle available to them, and have less money to buy it. This gap is likely to progressively widen as more information services are made available through the private sector of the economy, unless public sector information services keep pace by expanding their services at a comparable rate. If those who are born poor in our society are ever to have anything approaching equal opportunity, then the one resource that should be freely available to them should be education and information. Not all will recognize the need and take advantage of the opportunity, but a significant number may well do so if given the chance.

The separation between the private sector and the public sector of the economy is far from complete. Government regulatory actions (e.g., by the Federal Communications Commission) can stimulate or inhibit the development of private sector information services. Many of the public sector services are, in fact, purchased from the private sector (e.g., school textbooks, school construction, library books, and library buildings). What happens in one sector influences both the kinds and costs of services that are available in the other sector because of the variety of interactions, including cost reductions resulting from economies of scale. In our present and foreseeable economy it would be impossible to provide all the information services the society needs through public sector services. But government policy needs to be concerned with the entire problem, not just what has previously been the public sector component. Structuring and regulation of private markets to meet as many of the information needs of society as possible would permit available public sector funds to better meet information needs that cannot be met in the private sector.

One example of such an information policy relates to public television. Some of what is available on public television consists of cultural programs that tend to attract a small but affluent middle class audience. They are available on public television partly because the commercial television mass advertising market hasn't made it possible to economically serve such audiences. But the middle class audience could undoubtedly afford to pay

for the programming if there were a viable payment scheme. Conversion of such programs to a self-supporting pay TV operation could free those resources for meeting the information needs of the less affluent.

The example is not cited because it is necessarily the right approach for public television or any other public information service. Rather, it is intended to make the general point that public sector funds may be more efficiently spent if public policy makers and advisors look at the possibility of structuring private markets, as well as proposing public services.

The net impact of the information technology changes affecting public libraries during 1975-80 is likely to raise expectations of and increase demands of an increasingly media-sophisticated user population. The provision of pay video and computer information services to those who can afford it will not reduce demand for public information services. Rather, general awareness of the possibility and availability of such services is likely to greatly increase demand for libraries to provide such services also, at least for those who can't afford them any other way. The new technology (particularly computers) may permit libraries to reduce unit costs for some operations (provided there is cooperation on a sufficient scale that the economies can be obtained). But the lowered unit costs are likely to generate additional service demands that have a net effect of requiring increased total budgets. The new technology will permit a range of new services (e.g., video libraries or computer information retrieval services) that also generate new demands and require increased budgets.

The technology of national information networks (whether by satellite or terrestrial system or some combination) will permit greatly expanded inter-library networks in the 1975-80 period and permit limited experimentation with library to patron networks connecting libraries to homes via two-way cable television systems. Neither national nor local networks are likely to be economical for library service alone. But general purpose networks (possibly by satellite and cable television) may permit economical library service as one of many services sharing network costs.

IV. SOCIAL TRENDS

The concern of this essay in risking to enter that uncertain domain of social trends is to look only at those trends that could have a major impact on the demand for public information. Other trends are ignored. In an attempt to differentiate long-run trends from short-term fluctuations, trends are discussed only if they seem to be grounded in some underlying change in the technology or economics of the society. This criterion is based on the assumption that ideas and fads may come and go in the short run (periods of five years or less), stimulated by words and ideas and reactions to those ideas, but that lasting trends reflect underlying economic and technological change in the society. (This assumption does not deny that ideas don't in turn influence technology and economics. It merely asserts that in the time scale of looking at 1975-80 from 1973, the dominant effects will be of economics and technology on ideas, rather than the reverse.)

New Pluralism

Our society has always been a pluralistic society, despite many forces acting in the direction of homogenization. We began as a union of sovereign states in a country containing vast regional differences of geography, climate and economic resources, with people rich and poor, slave and free, native and immigrant. The wave of European immigration in the nineteenth century added new diversity of language and culture. Much of the diversity was lost as the union of states was forged into a single nation. A westward movement subjugated or destroyed the native Americans as the newcomers' culture was imposed on the continent. Distinctions

between slave and free were eliminated after a civil war. A public school system built on a 'melting pot' philosophy worked to reduce language and ethnic differences. Improved transportation and communication systems inter-connected geographic regions in ways that increased inter-dependence and somewhat reduced cultural diversity. Geographic and social mobility opened most segments of society to influences from other segments.

Nevertheless, there were always strong pressures to conformity within each segment of the soceity. Based partly on geography and partly on socio-economic class (which was itself often reflected in the geography of neighborhood boundaries), there were homogenizing pressures within each segment of society. That is, within each social grouping (usually delineated geographically) a tendency to reject those who differed from the local social norms and the reinforcement of conformity to cultural expectations was strong.

Now, the relentless pressure of improved social mobility (partly a result of improved economic conditions), physical mobility (a result of improved transportation technology), and psychic mobility (a result of improved communication technology) has served to reduce geographic differences in cultural style and at the same time introduce greater diversity into each geographic location. The improved economic condition of the society (for example, as compared to the depression of the 1930's), has meant that conformity to prescribed standards of behavior is not as strong a condition of economic survival as it once was. Some of the range of diversity that could previously be seen only by crossing geographic boundaries is now more evident within communities. As the proportion of people in the population with memories of the 1930's depression declines, this trend is likely to continue. In the absence of strong economic pressure forcing conformity as a condition for basic survival, the expression of the wide range of individual differences that characterizes humanity will emerge. Communication media and geographic mobility provide the models and economic security provides the opportunity.

Continuation of these trends toward a philosophy of tolerance of

diversity, or acceptance of people 'doing their own thing' is likely. The result appears to be the development of a multitude of sub-cultures with much different characteristics from the cultural variation of previous generations. Instead of each individual being in one sub-culture characterized by his race, occupation, geographic location, etc., that is stable over a long period of time, more and more people have simultaneous multiple sub-group (or sub-culture) memberships and belong to different sub-cultures at different points in time. Further, there are fewer geographic restrictions on sub-culture membership. People may belong to an occupation-oriented sub-culture with one circle of acquaintances, a recreational sub-culture with a different circle of acquaintances, belief oriented sub-culture, such as religious or political groups, and a neighborhood sub-culture. Unlike earlier times of lesser mobility, the the number of different sub-group memberships seems to be increasing.

In the early 1970's there are some signs of a reaction against the 'counter-cultures' that began to develop in the late 1960's. But this seems to be a minor ripple on the dominant trend. The basic values of the younger generation and of the more stable components of the 'New Left' are surprising similar to the libertarian views that are usually associated with 'conservative' economic philosophies. Among both conservatives and liberals there appears to be a trend away from paternalism and toward greater acceptance of more libertarian notions of individual freedom and responsibility.

The changes in information needs resulting from these trends is leading to changes in the mass media environment of the society in a way that leads to an acceleration of the trend. The death of mass circulation magazines (of which Life is the most recent in a long series of mass magazine failures) has received much publicity, but the magazine industry as a whole is thriving - with special interest magazines leading the way. Cable television and the coming of pay television in this decade will mark the beginning of a similar trend in electronic media. The trends toward pluralism and diversity in society and in the mass media are likely to provide continued impetus for each other for the foreseeable future.

The trend is toward specialized media services that don't fit geographic boundaries. Some may deplore the end of the 'melting-pot' of simultaneous nationwide exposure to very similar media content. Others may deplore the near complete erosion of local community control over local media content. But the trend seems inevitable. Instead of a small group of people determining the content of a sender-oriented mass media system, the incursions of pluralism and diversity are generating a media system more specifically tailored to specialized interests of sub-groups in the society. The ultimate extension of this trend is to a mass media system that functions very much like libraries - with individualized on-demand access to information.

The major implication for libraries concerns networking. Interconnection of libraries will be essential to make information available from an increasingly diverse body of knowledge to an increasingly diverse clientele. It will become more and more difficult for any local library to afford to store the entire range of information needed in its immediate geographic location, because information needs may be less determined by geographic boundaries. Local libraries may need to become one-stop switching and referral centers, interconnecting their clients to the appropriate place in a more complex national information network. The increase in diversity of information needs in each geographic location coupled with reduction of diversity among different geographic locations will increase the need for such referral services.

Openness or Privacy in Information Access?

The trend toward more openness and greater freedom of access to information is a dominant trend. The demands for less secrecy in government, greater public disclosure of corporate and product information, and greater freedom of access to information generally are likely to continue. Continuing increases in the average level of education in the society and improvements in information technology making information access technically easier will continue to provide fuel for this trend. The apparent countertrend toward more concern with privacy is not contradictory. Rather, it is

a reflection of the need to provide safeguards against abuse as the general trends make it economically and technically easier to obtain access to information. Often, the appropriate response to what at first glance appears to be an invasion of privacy problem may turn out to be a more widespread access rather than greater secrecy. For example, the requirement that the information in credit bureau data banks be more widely available (especially to the persons whose credit is being rated) seems a more satisfactory solution to credit bureau data bank abuses than restrictions on input to the data banks.

The implication for libraries is that there will be continued pressure for more information (especially government information) to be put in the public domain. At the same time there will be more demand for easier access to information that is nominally in the public domain. Whether the issue concerns actions of an executive branch agency or financial disclosure statements of elected officials, there is likely to be increased demand that such information be available locally (for example, through the local public library) and not just in some practically inaccessible office in Washington. The use in consumerism, and in greater citizen participation in decision making (e.g., as indicated by the rise of Ralph Nader's organization and Common Cause) are symptoms of this general trend.

Trends in Education

The area of social change with the most direct impact on information need or demands is education. As the average level of education increases, the aggregate demand for information increases. But income also tends to go up with education, making it easier to obtain information from commercial sources and possibly reducing (relatively) the need for free public information services. Increased school library services may reduce immediate demand on public library facilities but generate a greater awareness of and dependence on libraries that results in long-term continued demands for public library services. But these trends may have only minor impact relative to the dominant changes within education which appear to be shifting education (particularly continuing education) in the direction of

on-demand access to instructional resources. Since libraries have been the public institution most directly concerned with providing on-demand access to information and instructional material, this trend raises serious questions for library policy.

Changed conditions in society are placing three demands on educational institutions: equality of access to educational opportunity, lifelong learning, and diversity of curriculum content.

1) Demands for open enrollment in institutions of higher education are increasing, but the limitations of classroom and laboratory space and the costs of teaching personnel may make it difficult for many institutions to respond to those demands. In the Open University in the United Kingdom, television is being used to provide higher education to those not served by the traditional universities. This concept could be extended here to include all levels of education. Thus any person would be able to attempt any course he wanted to without requiring classroom space or teacher time. If success were rewarded without failures being recorded or there being other potential penalties for the student, many inhibitions about learning might be avoided and people might find their own levels of ability without others telling them what they can and cannot do. Regardless of economic efficiency, political and moral judgments will eventually require the provision of educational systems providing equal opportunity of access to education.

2) Formal education learned early in life can seldom last a lifetime. The need for periodic (or continuous) retraining is particularly great in occupations with a large scientific or technical component (for example, medicine, engineering). It seems unlikely that the concept of industry sabbaticals could be quickly implemented as a response to this need. Night school classes may provide a partial answer for some, but busy people or people with irregular schedules are often unable to make the kind of commitment required. Convenient, readily accessible educational materials are needed.

3) The trend in mass media and in education itself is toward more

variety. This cultural pluralism is already evident in the variety of special-interest magazines available and in the decrease in the number of mass-circulation magazines now published. The diversity of curricula now available to students lags behind the variety of occupations and interests available in society. Because it is already evident that no fixed curriculum will meet the present requirements for relevance and variety, the logical culmination of the situation is the provision of completely individualized instructional materials -- a state we are unlikely to attain without significant technological help.

If we project the labor costs and the building costs of meeting these three educational needs by traditional means, the projections become absurd. No matter how rich a society we become the percentage of resources needed would be too high to permit other essential activities.

Any policy that attempts to face these demands (or needs, or trends) in education will have a major impact on libraries. If new institutions are developed to provide on-demand instructional services, they would be providing service that has been a traditional function of libraries, hence potentially reducing library demand. (Alternately, it is possible that, as with other forms of education, more education will lead to more demand for library services.) The maximum increase in demand for library services would result if policies were developed to make libraries the primary institutions for on-demand access to instructional modules in a wide range of media over a wide range of subject matters.

The main reason why the growing demand for instructional services has not resulted in greater pressure on libraries is that our society lacks a general way of providing accreditation for self study. In order to obtain economic benefits from further instruction, many people need (or think they need) certification for what they have learned. Most educational institutions providing certification for learning are themselves providers of instruction and do not provide certification for what is learned elsewhere. A national examining university providing credit for self study programs, if coupled with provision for public libraries

to expand their print services and provide a variety of audio, video and possibly computer-based instructional modules, might be the most cost-effective educational investment possible. By utilizing existing institutions in a way that requires little in the way of new teaching staff or school buildings, major economies could be achieved over alternate schemes for achieving comparable levels of service.

Political Participation

More people are becoming involved in political activity at all levels of government. One consequence of this is increased demand for information about the decisions and the decision making processes of government agencies and committees. Some of the pressure toward less secrecy in congressional committee deliberations may be a consequence of this trend. Reforms requiring disclosure of political campaign contributions are another example. One result of this continuing trend will be increasing demands for accessibility of government information that is legally 'public' but difficult to obtain. Another will be increasing pressure to transfer more information into the public domain. A national policy to develop systems and techniques to reduce the cost of access by citizens to public governmental information may be an appropriate response to this trend.

V. POLICY IMPLICATIONS

The general economic, technological and social trends influencing the United States in the 1970's are certain to have a major impact on libraries and other institutions currently concerned with information production and distribution. Because so many of the expected shifts in the economy and technology are changes in the amount and the costs of information processing, traditional institutions concerned with information transfer should structure their policy planning within the general context of those trends. Otherwise, the policies that will have the most effect on libraries will be made elsewhere and libraries will be reduced to the role of passive observers of trends they are not effectively influencing or controlling.

The general areas of policy consideration can be subsumed under four general headings. First is national science policy. The second is education policy. The third is technology policy. The fourth is library policy. The first three are more likely to determine the role and function of libraries in society than is the fourth.

Science Policy

Recent changes in U.S. science policy have emphasized a shift away from a policy of supporting basic science or knowledge for its own sake as the primary goal of science policy. The new emphasis is on the development of science and technology that will help solve national problems or lead to increased economic growth. President Nixon's announcement in January 1973 of the abolition of the Office of Science and Technology and

the President's Scientific Advisory Committee signalled a formalization of the shift. The transfer of responsibility for federal science policy to the National Science Foundation, with NSF reporting to the chairman of the Council on Economic Policy, is a clear indication of the new context for science policy. The reorganization included establishment of a Federal Science Council, reporting to the director of NSF, to coordinate all government agency research and development programs, and the establishment of the Science and Engineering Council to provide NSF with advice from academic and industrial scientists and engineers. The rapid growth within NSF of the program on Research Applied to National Needs (RANN) is another example of the general science policy.

This general shift in science policy calls for a corresponding shift in policies for scientific and technical information. Much of earlier science information policy was concerned with information support for science and technology. Now a larger and even more challenging mission has been added. That is to develop information policies that will facilitate the application of scientific and technical information to solution of national problems and to facilitate national economic growth. In other words, in addition to maintenance of present information systems in support of science, information systems need to be developed to improve the flow of information between science and the rest of society. That information system needs a two-way flow, so that society can maximally benefit from the 'production of knowledge' and so that the scientific community better understands the problems for which they are asked to seek solutions.

Since the National Science Foundation now has the responsibility for both formulation and implementation of science policy, the National Commission should work closely with NSF in developing plans for new information services to meet the needs imposed by NSF's new mission.

A recent report by the Organization for Economic Cooperation and Development (OECD) contains a series of recommendations for national policy on scientific and technical information (OECD, 1971). That report, "Information For a Changing Society - Some Policy Considerations",

makes it clear that such policies must be formulated in the context of a more general approach to the problems of information and society. The transmittal letter from study group chairman Pierre Pigainol to the OECD Secretary-General focuses on the central question of economic growth. He says, "What are these hard facts? Obviously the central one is economic growth ... The problems of scientific and technical information seems to be closely linked with economic growth...." The detailed recommendations of that report warrant careful examination.

If the economic arguments concerning the growing importance of information for economic productivity are heeded, an expanded program of research and development on the role of information in society is called for. Investment in the science and technology of information processing may provide as much of a spur to economic development as investment in information services for science and technology.

One sub-area of research on information desiring special attention at this time is the economics of information. There are too few economists working in this area, and many promising avenues to explore. The goal of a cohesive program of research on the economics of information should be better understanding of the relationship between investment in information services and economic growth.

The National Commission might work with the National Science Foundation (and its Office of Science Information Services) to develop plans and recommendations for an expanded program of research and development in information science, including studies on the economics of information.

Education Policy

The need for economical open access to education by every member of U.S. society throughout his or her lifetime is now being articulated because it is technically possible to meet that need in the next two decades. The type of on-demand access to self study materials that has characterized libraries since their earliest days can be extended on a broader scale

throughout the society through electronic media. As the technology develops and understanding of its potential spreads throughout the society, the need will become expressed more stridently.

The development of facilities and institutions for alternate education or 'life-long learning' will create special demands on libraries. Open universities will require expanded service offerings by local libraries. Planning for open university services or experiments should include plans for increasing library resources to support such activities. One form of 'open schooling' that could be experimented with is the development of learning modules (in print, audio or video media) that could be made available through public libraries for self study programs.

Development of a national examining university to give academic credit or recognition to learning through self study programs would provide a major stimulus for and recognition of such programs. Developing an examining university that does not itself give courses may be the most economically productive option in the range of alternate education proposals.

Information Technology Policy

Libraries have for the past few years been discussing prospects for library networks. Unfortunately, specialized networks linking libraries together are usually expensive and seldom can be shown to produce benefits that justify the costs. If general purpose broadband electronic networks were available for communication of data and text throughout society, the social and economic benefits could be enormous. Library networking would constitute only a tiny fraction of the use of general networks, with business and other government services providing the bulk of the traffic. The resulting economies of scale would mean that library networks could be provided at an affordable incremental cost. The main justification for development of such networks would be for the general economic growth and improved social services that could result.

Two recent reports (one American and one Japanese) strongly recommend major investment in improved information technology as the key opportunity for improving economic productivity.

The most recent report is the U.S. study published in December 1972 by The Conference Board, titled "Information Technology: Initiatives for Today - Decisions that cannot wait". This report is particularly significant because it represents a set of policy recommendations, many requiring federal action, prepared under the direction of a prestigious organization of influential business executives, the Senior Executives Council of the National Industrial Conference Board. The recent report is Part Two of a major study of information technology. Part One, published in January 1972, titled "Information Technology - Some Critical Implications for Decision Makers", consisted of nine background papers discussing probable development in the information environment during the 1970's and 1980's.

The primary motivation for their policy recommendations is the improvement of U.S. economic productivity. One is left with the impression that building a broadband digital communications infrastructure for the society and developing the kinds of information services such as infrastructure would permit is the major opportunity for U.S. economic growth in the next decades. One is reminded of the economic growth made possible by the development of railroads as the major transportation infrastructure in the nineteenth century. Their concern is with information policy questions that extend much more broadly than libraries. With respect to libraries they say, (page 5) "What happens, for instance, when existing public information systems, such as libraries, are made obsolete by a network of automatic storage and retrieval systems?"

One of their key recommendations is, "Create an independent nonpolitical center with the capability to formulate alternative national policies in the area of information technology." They suggest such a center might be created at the behest of the President. The don't consider the possibility that the existing National Commission might take on some of those functions.

The second report that deserves careful consideration is the 1972 Japanese 'white paper' discussed earlier in this essay, recommending a series of detailed steps for Japan to take in the development of "The Information Society", steps they feel are necessary to maintain 10 per cent per year compounded growth rate in their economy. (The conference Board report quotes extensively from a preliminary 1970 version of the Japanese white paper.)

These reports, themselves a result of the underlying economic and technological trends that are the subject of this essay, point to a significant policy implication of those trends, namely that implementation of a coordinated national information policy is likely to produce significantly higher rates of economic growth than would otherwise obtain. This opportunity (especially when viewed in the competitive context of Japanese and European economic growth rates) may constitute the most significant information need of the United States in 1975-80. This need is for investment in information technology for economic growth. The proposal is to develop a technological information infrastructure that significantly lowers the unit costs of storing, retrieving, processing and transmitting information. Such a need does not deny the demands of different individuals and groups in society for 'consumption' of information, but it does put any cost-benefit calculations of the value of such information services into a quite different perspective.

The policies needed for development of the broadband information networks will require many novel features. Much of the investment will be made by the private sector of the economy. Federal funding may be appropriate for research and development activities and to pay for costs of public sector services (such as library interconnection and other education services) utilizing the networks. Many of the policies would be concerned with structuring of private markets such that sufficient incentives are available for orderly economic development. Some attention would have to be given to questions of technical standards and to regulatory policy (e.g., by the Federal Communications Commission). Federal policy may be more effective, however, if the influence on private

investment is more through positive economic leverage than negative regulatory sanctions. Voluntary standards may be sufficient without requiring mandatory standards if government funds are available for purchasing communication services from those suppliers who meet the standards.

The National Commission may wish to coordinate with the Department of Commerce, and especially its National Bureau of Standards and Office of Telecommunications, in the course of developing policy for information technology development.

Library Policy

Several conclusions regarding kinds of library services that should be made available can be drawn from the economic, technological and social trends discussed above.

1. Expanded audio and video services should be provided in response to the general shift toward greater use of such media that will occur during the rest of this decade.

2. Greater emphasis on information for the information poor will be necessary to partially counterbalance the likely widening of the gap between the information rich and the information poor that will result from increased commercial development and exploitation of information technology (including pay television).

3. Switching centers and referral services should be developed so that libraries can come closer to meeting the widening diversity of information needs, even though it may be uneconomical to provide a full range of service in each local library.

4. Consideration should be given to improving access of each citizen to public information about government services and government decision making at all levels. Minutes and supporting documents of all local government boards and committees could be made more accessible through local

libraries, for example. Within a few years a national network of federal government information could be made available to local libraries via computer time-sharing and information retrieval techniques, just as medical references are made available to the medical libraries by the National Library of Medicine's Medline system. Computerized congressional information systems now being developed could be made nationally accessible by the Library of Congress.

5. National service to local libraries (e.g., on-line computerized searches of the Library of Congress MARC files) could be provided (analogous to Medline) to make national bibliographic information readily accessible throughout the country.

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